

TWO NEW SPECIES OF *LARICOBIVS* (COLEOPTERA: DERODONTIDAE)
FROM CHINA, AND A KEY TO *LARICOBIVS* IN THE
SOUTHEASTERN PALAEARCTIC

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Abstract.—*Laricobius baoxingensis* Zilahi-Balogh and Jelínek, n. sp., and *Laricobius kangdingensis* Zilani-Balogh and Jelínek, n. sp., are described from Sichuan Province, China, and the Himalayas. They are compared with other species of the genus from China and a key is provided for the southeastern Palearctic species. Both species are associated with adelgids of the genus *Adelges* on *Tsuga chinensis*.

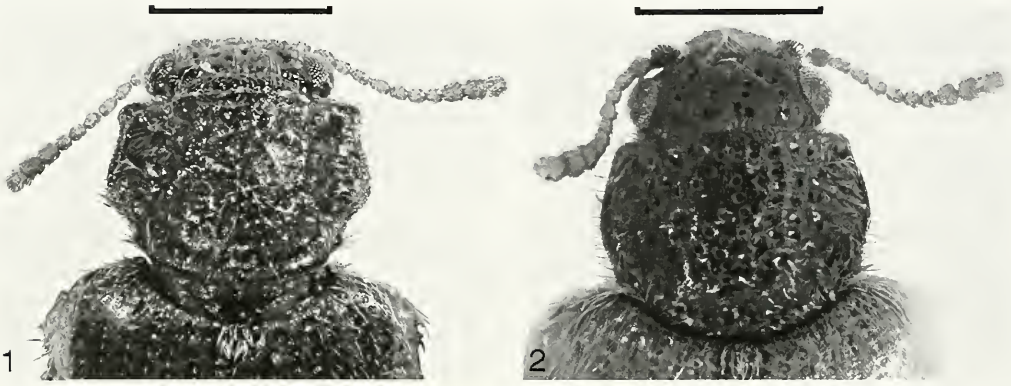
Key Words: *Adelges*, description, taxonomy, *Tsuga*

Laricobius Rosenhauer is one of four genera in Derodontidae that occupies cooler temperate regions of both the Northern and Southern hemispheres (Lawrence 1989). Members of this genus are known to be adelgid specialists (Hemiptera: Adelgidae), while the other three genera are mycophagous. (Lawrence and Hlavac 1979, Lawrence 1989). Nine species of *Laricobius* have been described from the Palearctic and Nearctic regions. Only two species, *Laricobius erichsonii* Rosenhauer and *L. nigri-nus* Fender have been studied in any detail as part of larger investigations evaluating their suitability in biological control of *Adelges piceae* Ratzeburg (Clark and Brown 1958; Franz 1958a, b; Brown and Clark 1962) and *Adelges tsugae* Annand (Zilahi-Balogh et al. 2002, 2003a, b, c).

Adelges tsugae is an introduced and destructive pest of *Tsuga canadensis* (L.)

Carrière and *T. caroliniana* Engelmann in the eastern United States (McClure and Cheah 1999). A large-scale effort in classical biological control of *A. tsugae* has been on-going since the mid-1990s (Salom et al. 2001). Because of the specialized feeding habit of *Laricobius* on adelgids, an expedition was undertaken in April 2002 to southwestern China, the native range of *A. tsugae*, to survey and collect *Laricobius* and other predators from regions where *Tsuga* naturally occurs. Collected material was returned to the United States alive and evaluated for suitability as biological control agents of *A. tsugae* under quarantine at the Beneficial Insect Laboratory, Virginia Polytechnic Institute and State University, Blacksburg, VA.

Subsequent to Lawrence and Hlavac's (1979) review of the Derodontidae, several new species have been described. These include: *L. kovallevi* Nikitsky and



Figs. 1–2. Pronota. 1, *Laricobius baoxingensis*. 2, *L. kangdingensis*. Scale bars = 0.5 mm.

L. minutus Nikitsky, from Siberia (Nikitsky and Lafer 1992); *L. loebli* Jelínek and Háva (Jelínek and Háva 2001) and *L. schawalleri* Háva and Jelínek from Nepal (Háva and Jelínek 2000); and one species, *L. mirabilis* Háva and Jelínek from China (Háva and Jelínek 1999).

We describe two new species, *L. baoxingensis* and *L. kangdingensis* collected from adelgid-infested *T. chinensis* (Franchet) Pritzel from southwestern China. Biological and habitat information are included as well as a key to *Laricobius* species from the southeastern Palaearctic. Described specimens were compared with *L. erichsonii*, *L. nigrinus*, and *L. rubidus* Le Conte by GZB and with *L. loebli*, *L. schawalleri*, and *L. mirabilis* by JJ.

KEY TO SOUTHEASTERN
PALAEARCTIC *LARICOBIOUS*

- 1 Sides of pronotum emarginate posterad to anterior angles 2
- Sides of pronotum not emarginate posterad to anterior angles (Figs. 1–2) 3
- 2 Pronotum with small distinct subrectangular to obtuse posterior angles. Elytra less than 1.5× longer than their combined width 4
- Posterior angles of pronotum indistinct, anterior ones acutely projecting laterally (see fig. 6 in Jelínek and Háva 2001). Elytra 1.53–1.55× longer than their combined width. Red brown with brown yellow appendages, coloration possibly variable.

- Length 3.0–3.2 mm, width 1.3–1.5 mm. China *L. mirabilis* Háva and Jelínek
- 3 Pronotum 1.32–1.36× wider than long, more strongly narrowed posteriorly than anteriorly, sides of pronotum distinctly emarginate anterad to posterior angles (Fig. 1). First complete elytral stria deeply incised and impunctate in apical one-third. Dark red brown. Head pitchy black. Length 2.5–2.6 mm, width 1.1–1.2 mm. Southwestern China *L. baoxingensis*, n. sp.
- Pronotum 1.21–1.25× wider than long, equally narrowed both anteriorly and posteriorly, sides of pronotum hardly emarginate anterad to posterior angles (Fig. 2). First complete elytral stria shallow and distinctly punctate in apical one-third. Yellow brown to piceous. Head and pronotum dark brown to black. Length 2.1–2.4 mm, width 1.0–1.1 mm. Southwestern China *L. kangdingensis*, n. sp.
- 4 Pronotum narrower, less than 1.2× wider than long. Lateral margins of pronotum regularly outcurved in median portion, equally converging both anteriorly and posteriorly (see fig. 4 in Jelínek and Háva 2001). Elytra 1.33× longer than their combined width. Black; appendages brown yellow; femora at least partly black. Length 2.4 mm, width 1.2 mm. Nepal *L. loebli* Jelínek and Háva
- Pronotum wider, more than 1.2× wider than long. Lateral margins of elytra asymmetrically outcurved in median portion, more strongly converging anteriorly than posteriorly (see fig. 2 in Jelínek and Háva 2001). Elytra 1.44× longer than their combined width. Brown yellow; elytra black, suture behind transverse impression and subtriangular apical area brown yellow.

Table 1. Characters differentiating *Laricobius baoxingensis* and *Laricobius kangdingensis*.

<i>Laricobius baoxingensis</i> (Fig. 4)	<i>Laricobius kangdingensis</i> (Fig. 5)
Pronotum strongly transverse, 1.32–1.36× wider than long, and more strongly narrowed posteriorly, P/A index (ratio distance between posterior angles : distance between anterior angles) 0.88–0.93; sides anterad to posterior angles distinctly concave.	Pronotum less transverse, 1.21–1.25× wider than long, almost equally narrowed both anteriorly and posteriorly, P/A index 0.95–1.07; sides anterad to posterior angles almost rectilinear, at most feebly concave.
Sides of pronotum narrowly explanate, nearly as wide as antennal flagellum.	Sides of pronotum only narrowly bordered, not explanate.
Elytra comparatively shorter, 1.51–1.52× longer than combined width.	Elytra comparatively longer, 1.58–1.65× longer than combined width.
First complete elytral series of punctures in apical portion deeply incised as continuous furrow with indistinct and widely spaced punctures.	First complete elytral series of punctures in apical portion shallowly impressed, with normally developed punctures.

low; appendages brown yellow. Length 2.3 mm, width 1.1 mm. Nepal
 *L. schawalleri* Háva and Jelínek

***Laricobius baoxingensis* Zilahi-Balogh
and Jelínek, new species**

(Figs. 1, 4)

Diagnosis.—*Laricobius baoxingensis* differs from *L. mirabilis* Háva and Jelínek (1999) especially in the shape of pronotum, which is markedly more transverse and less strongly convex than in *L. mirabilis* (width : length ratio 1.32–1.36 in *L. baoxingensis*, 1.22–1.24 in *L. mirabilis*), with obtuse and not prominent anterior angles (acutely projecting laterally in *L. mirabilis*) and with small but distinctly developed subrectangular posterior angles (indistinct in *L. mirabilis*). Both anterior and posterior pronotal angles are similarly developed in another sympatric species, *L. kangdingensis* (see Table 1 for distinguishing characteristics). In the key to the *Laricobius* species of the Himalaya and China (Jelínek and Háva 2001) *Laricobius baoxingensis* sp. n. agrees with the Himalayan species *L. schawalleri* Háva and Jelínek (2000) and *L. loebli* Jelínek and Háva (2001) in having distinct posterior pronotal angles, but differs from them in having comparatively

longer elytra, 1.5× longer than their combined width; it shares the latter character with *L. mirabilis*. However, *L. baoxingensis* sp. n. differs from all species mentioned above in the lack of the constriction (emargination) behind the anterior pronotal corners (see figs. 4–6 in Jelínek and Háva 2001).

Description.—Holotype, female. Body oblong oval, dark red brown. Head, scutellum, scape, ventral surface including elytral epipleura and femora pitchy black, tibiae black brown. Pubescence semierect, red-orange. Length 2.5 mm, width 1.2 mm.

Head: Across eyes narrower than anterior margin of pronotum. Eyes somewhat asymmetrically vaulted dorsally before midlength (dorsal view), finely faceted. Temples almost indistinct. Frons flat with a few large pit-shaped punctures irregularly dispersed, sparsely punctate between large punctures; punctures on clypeus and anterior corners of eyes almost as large as eye facets, separated by one diameter or less of width of eye facet.

Antenna: Nearly as long as anterior pronotal margin; antennomeres 3–5 subequal, longer than wide, antennomeres 6–8 subequal, nearly as long as wide.

Pronotum (Fig. 1): Transverse, widest at its midlength, $1.36\times$ wider than long. Anterior margin subtruncate, anterior angles blunt, not prominent, posterior ones small, subrectangular, protuberant, situated at three-fourths of pronotum length. Lateral margins in anterior portion almost rectilinear, moderately diverging posteriorly, abruptly arcuately curved in median portion and more strongly converging posteriorly, arcuately emarginate before posterior angles. Basal margin arcuate, bordered by deep furrow with series of large punctures separated by less than one diameter puncture width. Disc of pronotum broadly transversely convex, sides with low and broad lateral bulge at midlength, deeply impressed anterior and posterior to bulge. Lateral margins with explanate border almost as wide as antennal flagellum. Pronotal disc with irregularly dispersed large pit-shaped punctures equal to those on frons, interspaces uneven, sparsely and finely, in posterior half indistinctly, punctate. Lateral bulges densely finely punctate. Scutellum small, rounded, finely and densely pubescent.

Elytra: $3.2\times$ longer than pronotum, widest behind midlength, $1.53\times$ longer than combined width and reaching maximum length at suture. Surface seriate-punctate, transversely convex with median portions of lateral margins not visible simultaneously from above, transversely impressed at basal one-fourth. Suture depressed before transverse impression, raised and roof-shaped posteriorly. First (scutellar) stria reaching only to transverse impression. Punctures of each stria separated by nearly one diameter, first complete stria in apical one-third deeply incised as continuous furrow with indistinct and widely spaced punctures smaller than preceding ones. Interstriae (at least 1–4) wider than striae, apparently smooth except for median

portion of sutural interstriae, which is distinctly punctate.

Variation.—Body length 2.5–2.6 mm, width 1.1–1.2 mm. Pronotum 1.32 – $1.36\times$ wider than long.

Types.—Holotype, ♀, China, Sichuan province, Niba Gao Forestry Station (Lat./Long.: $30^{\circ}41'13''\text{N}/102^{\circ}41'44''\text{E}$); elevation 2560 m; near Qiagi village, Baoxing county; collected 5–8 April 2002 by TJM and GMG Zilahi-Balogh. Paratypes: 4 ♀, same data as holotype. Holotype and 1 paratype deposited in Institute of Zoology, Academia Sinica (IZAS), Insect Collection, 19 Zhongguancun Lu, Haidian, Beijing, 100080, China; 1 paratype deposited in Czech National Museum (Natural History) (NMPC), Department of Entomology, Kunratic 1, Prague 4, 148 00, Czech Republic, and 1 paratype is deposited in National Museum of Natural History, Smithsonian Institution (NMNH), Washington, DC, USA.

Etymology.—Named after Baoxing, the county in Sichuan province, China, where the type series was collected.

Distribution.—China: Sichuan Province.

Host.—Adults collected in association with *Adelges* (Adelgidae) on *Tsuga chinensis* (Franchet) Pritzel.

Habitat.—Mixed evergreen broadleaf forest; elevation 2600–2900 m, northern aspect; secondary forest; species composition 50% *Picea* sp., 24% *Abies* sp., 18% *Tsuga chinensis*, 5% *Larix potanini* Batalin, 3% *Betula* sp.; understory 40% bamboo, 5% *Rhododendron* sp.

***Laricobius kangdingensis* Zilahi-Balogh and Jelínek, new species**

(Figs. 2–3, 5)

Diagnosis.—With obtuse anterior and distinct posterior pronotal angles, sides of pronotum not emarginate behind anterior angles and comparatively long elytra. *Laricobius kangdingensis* is similar

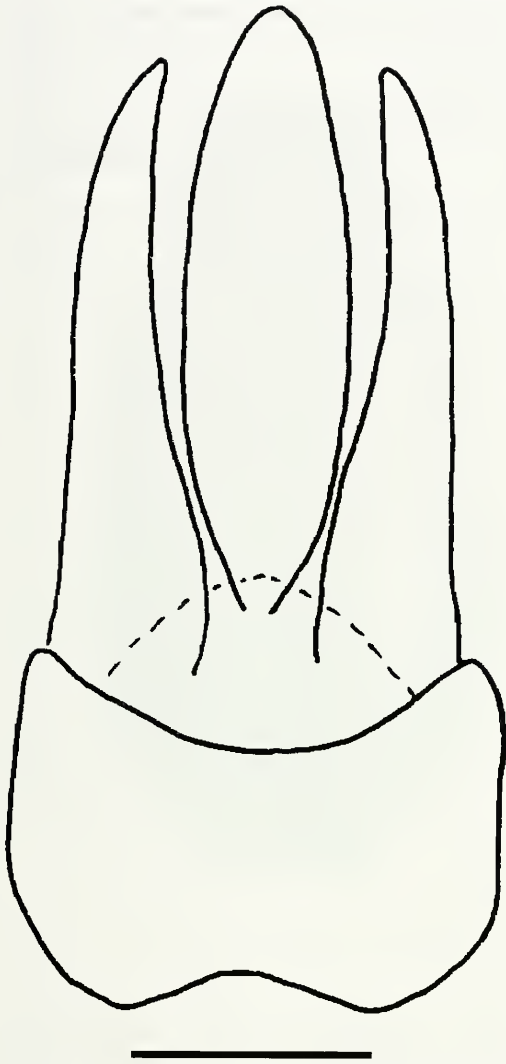


Fig. 3. Aedeagus of *Laricobius kangdiugensis*. Scale bar = 0.1 mm.

to *L. Baoxingensis*, but the two species differ in the characters given in Table 1.

Description.—Holotype, male. Body ovate, convex. Head, scutellum, scape, ventral surface, legs, and pronotum black, elytra, rest of antenna and tarsi dark yellow brown. Pubescence erect, tan. Length 2.3 mm, width 1.0 mm.

Head: Across eyes narrower than anterior margin of pronotum. Eyes regularly convex. Frons flat with a few deep and large pit-shaped punctures

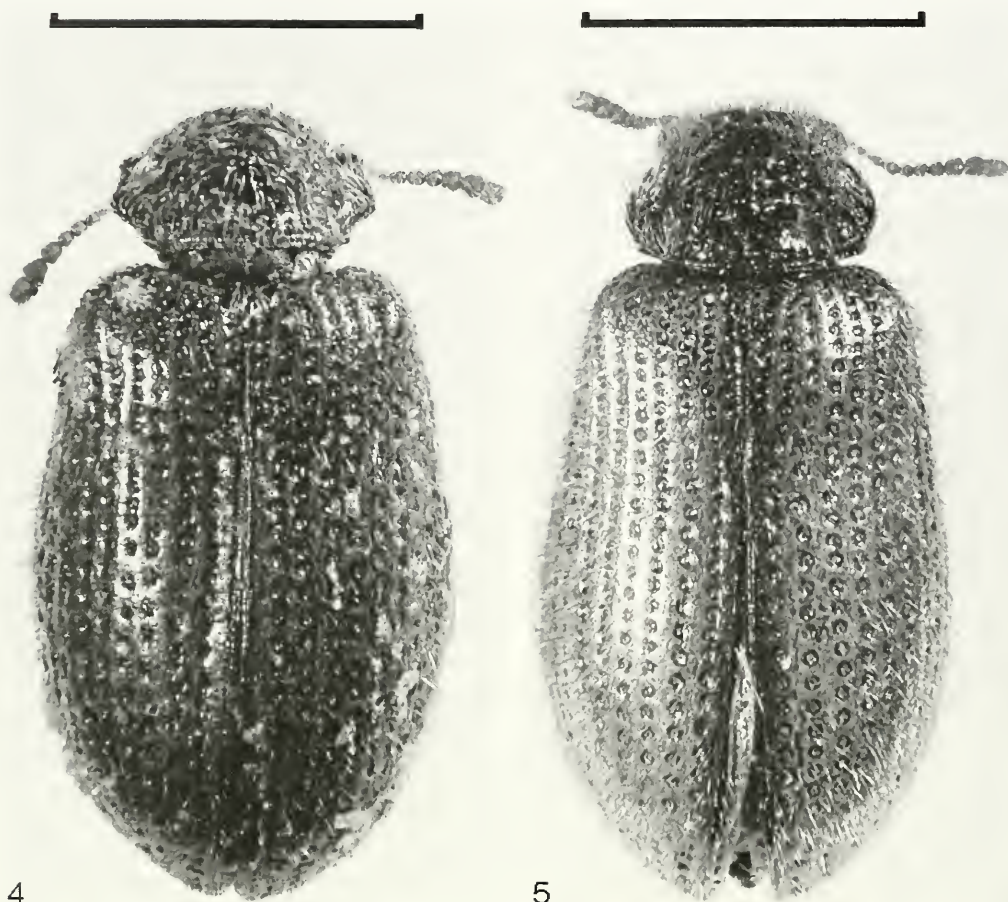
irregularly dispersed besides eyes and on vertex. Median portion flatly vaulted, sparsely and finely punctate, separated from clypeus by arcuate transverse impression. Clypeus densely finely punctate, punctures fairly equal in size to eye facets and separated by one eye facet diameter or less.

Antenna: Nearly as long as width of pronotum; antennomeres 4 and 5 subequal, longer than wide; 6 and 7 subequal, longer than wide, but shorter than preceding ones; 8, nearly as long as wide.

Pronotum (Fig. 2): Transverse, widest at midlength, $1.21\times$ wider than long. Anterior margin broadly arcuate, anterior angles distinct, obtuse, not prominent. Lateral margins arcuate, narrowly bordered, anterior portions almost rectilinear, posterior ones feebly concave. Posterior angles distinct, small, rectangular, nearly as far apart as anterior ones. Basal margin arcuate. Disc transversely convex, at midlength projecting laterally into less convex transverse bulges. Surface with irregularly dispersed large and deep pit-shaped punctures separated by one puncture diameter or less; interspaces indistinctly microscopically punctate.

Elytra: Widest behind their midlength, $1.65\times$ longer than their combined width and $3.05\times$ longer than pronotum, reaching maximum length at suture. Surface strongly transversely convex, seriate-punctate, transversely impressed at one-fourth of elytral length; lateral margins not visible simultaneously from above. Serial punctures large, umbilicate, punctures in same row separated by nearly one puncture diameter; interstriae wider than striae, indistinctly microscopically punctate, basal punctures larger. Serial punctures not impressed except for the shallowly impressed apical portion of the first complete stria, interstriae flat.

Male genitalia (Fig. 3): Lateral lobes of aedeagus narrower at the apex, while median lobe is not tapered as in *L. erichsonii* Rosenhauer (Brown 1944).



Figs. 4-5. Adults. 4, *Laricobius bauxingensis*. 5, *L. kangdingensis*. Scale bars = 1 mm.

Variation.—Color pattern variable in type series, suture and 2-3 outermost interstries in some specimens black, one male except for antennae and tarsi completely black. *Pronotum*. 1.21-1.25 \times wider than long, elytra 1.58-1.65 \times longer than their combined width. Number and pattern of deep large punctures of frons variable and often asymmetrical, but the median subtriangular impunctate bulge as well as the deep arcuate impression separating the bulge from clypeus always distinct.

Types.—Holotype, ♂ China, Sichuan province, Simaqiao Forestry Station (Lat./Long. 29°59'10"N/101°56'46"E), approximately 5 km west of Kangding

City, Kangding County; collected 12 April 2002 by G. M. G. Zilahi-Balogh and T. J. McAvoy. Paratypes: 3 ♂, 2 ♀, same data as holotype. Holotype and 1 paratype deposited in IZAS; 1 paratype (♂) deposited in NMPC; and 2 paratypes (♀, ♂) deposited in NMNH.

Etymology.—Named after Kangding, the county in Sichuan Province, China where the type series was collected.

Distribution.—China: Sichuan Province

Host.—Larvae collected in association with *Adelges* (Adelgidae) on *Tsuga chinensis*.

Habitat.—Mixed evergreen broadleaf forest; elevation 2840 m, northwest as-

pect; secondary forest. Species composition 30% *Pinus armandii* Franchet, 25% *Picea* sp., 10% *Tsuga chinensis* (Franchet) Pritzell, 10% *Betula* sp.; understory 5% *Rhododendron* sp., 5% *Bambusoideae*.

Biology.—Larvae collected in association with *Adelges* on *Tsuga chinensis* 12 April 2002, completed their development at 15°C, 12:12 h (L:D) with *Adelges tsugae* Annand on *T. canadensis* under quarantine at Virginia Polytechnic Institute and State University, Blacksburg, Virginia (USA). Mature larvae migrated to the soil to pupate between 29 April and 9 May 2002. Eclosed adults remained in the soil in aestivation, resuming activity on hemlock foliage between 11 September and 1 October 2002, about the same time that *A. tsugae* broke aestival diapause and resumed development. Oviposition in the laboratory was first observed in November 2002. Gatton (2005) determined the fecundity of the parental generation and development of the F₁ generation.

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